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Assessing tactile acuity in musculoskeletal medicine: how good are two point discrimination tests at the neck, hand, back and foot?

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Assessing tactile acuity in musculoskeletal medicine: how good are two point discrimination tests at the neck, hand, back and foot?

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Body in Mind
research into the role of the brain & mind in chronic pain
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Chronic pain from musculoskeletal conditions is associated with cortical changes and altered tactile acuity. For this reason, tactile acuity is considered a clinical signature of primary somatosensory representation and is increasingly being assessed in both clinical practice and research. Clinicians from a range of professions, use two-point discrimination (TPD) to evaluate the extent of cortical reorganisation in chronic pain and monitor change as patients recover. In research, TPD is an important outcome measure and given the growing emphasis on retraining the brain for chronic pain conditions, the clinimetric properties of this measure are especially important.

Despite the widespread use of the measure, the utility, reliability and precision of the measure at commonly assessed sites, has not been interrogated. The aim of this study therefore was to determine, in a large cohort of clinicians with variable experience and minimal training and in a clinically pragmatic fashion, the utility, intra- and inter-rater reliability, bias and variability of TPD threshold assessment at the neck, back, hand and foot, using inexpensive mechanical callipers.

KEY MESSAGE

- Cortical reorganisation and altered tactile acuity are both associated with chronic pain conditions
- Individual clinicians can reliably assess TPD thresholds in the neck, back, hand and foot using callipers.
- Comparisons between two different clinicians were reliable for only the neck and the foot.

DESIGN

- Intra- and inter-rater reliability of TPD was assessed in the back, neck, hand and foot.

PARTICIPANTS

- 28 (19 male) physiotherapists assessed the tactile acuity of 28 (11 male) healthy young subjects (mean age: 24.1 (SD 4.7)).
- Previous experience in the assessment of TPD was not required.

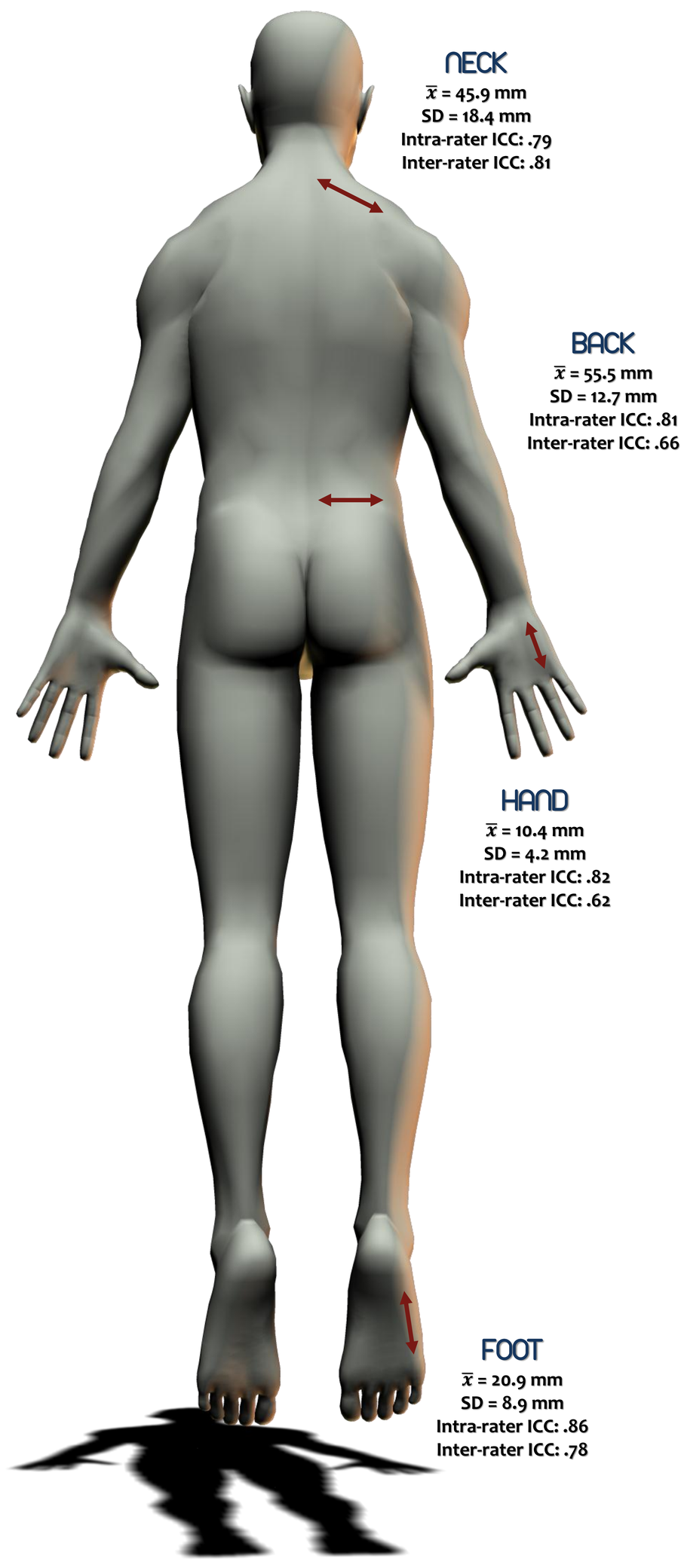
TPD ASSESSMENT

- Each clinician received 30 minutes training in the assessment of TPD using hardware style mechanical callipers (shown below) with a precision of 1mm.
- For the neck and back, clinicians located the spinous process of C7 and L3 respectively and assessed TPD horizontally out from the midline toward the subject's dominant side.
- For the hand, clinicians located the pisiform on the palmar aspect of the hand and assessed TPD distally along the hypothenar eminence.
- For the foot, clinicians located the base of the 5th metatarsal on the latero-volar aspect of the foot and assessed TPD distally along the lateral margin of the sole.
- The callipers were applied with sufficient pressure to blanch the skin. Assessment commenced with 0mm between the two points and was gradually increased until the subject discerned two points. A series of five ascending and descending assessments, centred around the subject's TPD threshold, was conducted and the average of these assessments was analysed.
- Each subject reported 'one' if they felt one point or 'two' if they felt two points after each application. If unsure, they reported one point. The only feedback they gave the assessor was if they discerned two points because of a temporal delay between each point. When this occurred, that report was rejected.

Mechanical callipers used to assess TPD

ANALYSIS

- Intra-correlation coefficients (ICC) and Bland-Altman plots were used to assess repeatability, bias and variance.
- ICCs were used to determine the absolute agreement between assessments. A two-way random model was chosen because both the subjects and the clinicians were considered random effects.
- ICC values ≥ .75 were interpreted as good reliability.
- Bland-Altman plots were constructed to determine bias, variability and agreement.
- The effect of clinician experience on reliability was assessed using an independent t-test. An arbitrary cut-off of greater than five years clinical practice was chosen a priori to categorise clinicians as inexperienced or experienced. significance was set at α=0.1.



NECK
$\bar{x}$ = 45.9 mm
SD = 18.4 mm
Intra-rater ICC: .79
Inter-rater ICC: .81

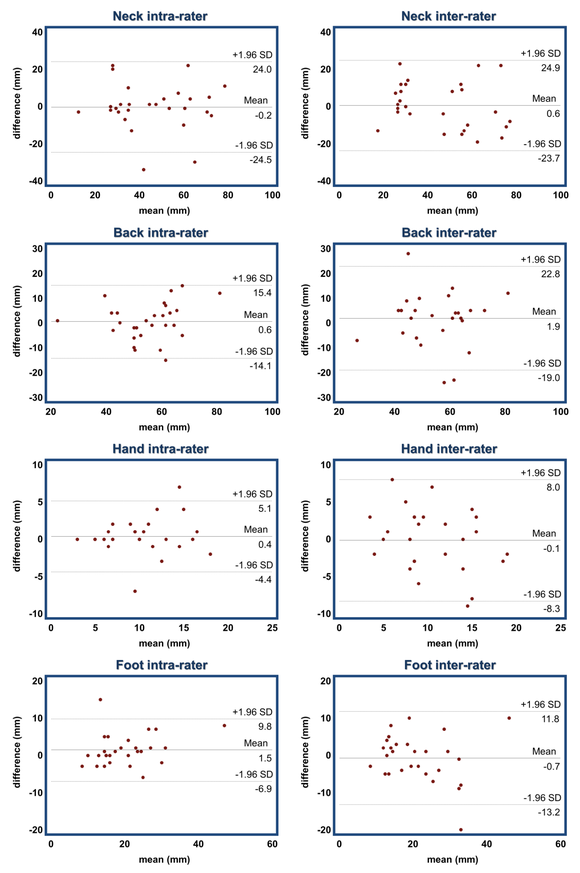
BACK
$\bar{x}$ = 55.5 mm
SD = 12.7 mm
Intra-rater ICC: .81
Inter-rater ICC: .66

HAND
$\bar{x}$ = 10.4 mm
SD = 4.2 mm
Intra-rater ICC: .82
Inter-rater ICC: .62

FOOT
$\bar{x}$ = 20.9 mm
SD = 8.9 mm
Intra-rater ICC: .86
Inter-rater ICC: .78

RESULTS

- Intra-rater assessments in all four regions and inter-rater assessments in the neck and foot were reliable (ICC range: 0.79 - 0.86) but large variability was seen in all assessments.
- Inter-rater assessment of the back (ICC = 0.66) and hand (ICC = 0.62) were deemed unreliable.
- No bias was evident and the experience of the clinician had no effect on TPD measures ($p>0.14$).
- Bland-Altman plots for the intra- and inter-rater performances are shown below.
- The mean differences in all plots were close to zero suggesting that there was no systematic learning or fatigue effects.
- The plotted differences showed large variability, indicative of error, suggesting that TPD assessment is reliable but not precise.



Bland-Altman plots

SUMMARY

Clinicians with variable experience and minimal training are able to quickly and reliably assess TPD thresholds in the neck, back, hand and foot using inexpensive mechanical callipers. Measures obtained by different clinicians were only reliable for the neck and the foot. Large variability was observed in all assessments, which suggests clinicians should be cautious when interpreting changes in tactile acuity in individual patients and researchers must account for this variability when calculating suitable sample sizes.

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